UNM SCHOOL *of* ENGINEERING

Department of Nuclear Engineering

May 22, 2017

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject: Docket No. 50-252, Facility License R-102

Submittal of University of New Mexico AGN-201M Facility Response to Request for Additional Information regarding Amendment to Facility Operating License No. R-102 for the University of New Mexico Aerojet General Nucleonics AGN-201M Reactor (TAC No. MF5583).

Transmitted herewith is our formal response to your Request for Additional Information (RAI), dated April 25, 2017, regarding an amendment to the AGN-201M facility license. The enclosure contains the responses to the two items.

If there are any questions or concerns with this response please contact me at (505) 277-8027, and/or e-mail me at busch@unm.edu

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 22nd, 2017.

Respectfully Submitted

A020
NRR

Robert D. Busch, Ph.D, P.E.
Chief Reactor Supervisor, UNM AGN-201M Reactor

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Response to Request for Additional Information
From The University of New Mexico
AGN-201M Reactor
Docket 50-252

RAI responses on UNM Facility Operating License No. R-102 (TAC No. MF5583)

1. The requested change to the Technical Specifications regarding the definition of Explosive Material is hereby withdrawn. We will keep the current definition as below:

1.1.9 Explosive Material - Explosive material is any solid or liquid which is given an Identification of Reactivity (Stability) index of 2, 3, or 4 by the National Fire Protection Association in its 704 Diamond, Hazard Rating System.

2. Because there are multiple labels used throughout the Safety Analysis Report to refer to the Room where the reactor is housed, we are requesting that the single identifier, reactor room, be used in both the Technical Specifications and the Safety Analysis Report. The request for these changes in the Technical Specifications has been previously submitted. The following changes are requested in the SAR, (current wording identified in *italics*, requested changes identified in **Bold**).

Table of Contents,
It was noticed that the page numbers in the TOC for Item IV, Reactor Building, IV.A Laboratory Building, and IV.B Reactor Laboratory were incorrect in the existing SAR and should be changed to match the actual numbers.
Also, the label on Item IV.B. be changed from *Reactor Laboratory* to **Reactor Room**

Page 14 - Paragraph D.3 – Radiation Monitoring Equipment would be changed from:

Radiation monitoring instrumentation available to the reactor operators includes console-mounted meters and a portable survey meter. These and other such instruments available within the *reactor laboratory* are calibrated periodically by the Radiation Safety Department of the University.
to:
Radiation monitoring instrumentation available to the reactor operators includes console-mounted meters and a portable survey meter. These and other such instruments available within the **Reactor Room** are calibrated periodically by the Radiation Safety Department of the University.

Page 28 - Reactor Building, A. Laboratory Building

In the paragraph describing the laboratory, the fifth sentence will be changed from:

The roof of the building over the *Reactor Laboratory* is three feet of earth between five inch thick concrete slabs.

to:

The roof of the building over the **Reactor Room** is three feet of earth between five inch thick concrete slabs.

Page 31 – Will be changed from:

B. *Reactor Laboratory*

The Reactor Laboratory is located in the southeast corner of the Laboratory Building in a room 20 x 24 feet. This room has two access doors: (1) a personnel door in the north wall of the room, and (2) a double door for equipment and personnel access in the west wall of the room. In addition to having six feet of earth between one foot thick concrete slabs, the south wall of the *Reactor Laboratory* is entirely below grade level. The east wall is essentially below grade level because of the exterior concrete stairs that go from the floor elevation up to the street level.

to:

B. **Reactor Room**

The Reactor Room 065 in Figure 17, (20 x 24 feet) is located in the southeast corner of the Laboratory Building. This room has two access doors: (1) a personnel door in the north wall of the room, and (2) a double door for equipment and personnel access in the west wall of the room. In addition to having six feet of earth between one foot thick concrete slabs, the south wall of the **Reactor Room** is entirely below grade level. The east wall is essentially below grade level because of the exterior concrete stairs that go from the floor elevation up to the street level.

The facility layout has not changed; the only change requested is to standardize the label, Reactor Room," to apply to room 065 where the reactor and control panel are located. This change is to minimize confusion between the Laboratory Building, a stand-alone structure containing a number of room and the Reactor Room, a single room housing the reactor and control panel.

The affected pages of the current SAR are provided in Appendix A with inked corrections identified. Appendix B provides the same pages with the proposed changes inserted in the document at locations indicated by vertical change bars.

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c) Channel 3: Boron Lined Ionization Chamber

Proper operation of Channel 3 is a license requirement. It provides log picoammeter response. The detector consists of a positively-biased (600 VDC) boron-lined, gas filled ionization chamber. The log picoammeter is used to assure operation within power limitations (1.2 x licensed full power per T.S.2.2.a).

d) Auxiliary Channel: Boron-Lined Ionization Chamber

Similar to Channel 2 and 3 detectors, this channel is an auxiliary monitor, which can be used for highly accurate reactivity insertion measurements or data acquisition. This process is accomplished by adding a series current source (from the installed current supply) to cancel the detector signal. This highly accurate differential measurement allows current changes to be recorded with two orders of magnitude better resolution than from the detector alone. It also records the current measurements every 0.25 seconds and writes it to a file on a computer in ascii format for easy retrieval.

2) Safety Interlocks

There are three safety interlocks included in the reactor instrumentation. If any one of the three is tripped, a light is activated on the control panel and magnet current to the rod drives is deactivated (scrammed condition). Those interlocks are as follows:

a) Shield water level monitor. Float-type monitor trips if water level is more than 18 cm below the highest point on the reactor shield tank manhole opening.[T.S.3.2.g]

b) Shield tank temperature. Thermostat trips if shield water temperature drops below 18°C.
[T.S.3.2.h]

c) Earthquake switch. A small stainless steel ball is dislocated by heavy vibration causing a horizontal displacement of 0.16 cm or greater breaking the continuity of the electrical circuit and causing a tripped condition. [T.S.3.2.i]

3) Radiation Monitoring Equipment

Radiation monitoring instrumentation available to the reactor operators includes console-mounted meters and a portable survey meter. These and other such instruments available within the ~~reactor laboratory~~ Reactor Room are calibrated periodically by the Radiation Safety Department of the University. There are remote area monitors with automatic alarms installed to monitor gamma levels at the reactor console, check point three (on the south side of the reactor), reactor top, and in the general lab area (near the east door). All of this instrumentation is listed in Table 2 below:

Demography

The population densities around the Nuclear Engineering Laboratory listed below in table 5 were calculated from 2000 Census Blocks obtained form the city of Albuquerque.

Table 5 – Population in the Reactor Vicinity

Radial Distance (miles)	Population	Area (sq. mi.)	Population Density (per sq. mi.)
1	16,808	3.14	5352.9
5	244,518	78.53	3113.7

The University of New Mexico has about 27,000 students that attend the main campus. The number of people on campus during the work week is significantly higher than the residential population.

IV. Reactor Building

A. Laboratory Building

The laboratory is a one story concrete structure with six feet of earth between one foot thick concrete walls on the south and west sides. The north and east walls are poured concrete approximately one foot thick. A floor plan is shown in Figure 17. The only outside windows in the building are in the entrance doors. There are four entrance doors into the building: (1) a personnel door on the east side, (2) a personnel door (3) a double-width equipment door on the north side (center), and (4) a personnel door on the north side (west end) which is bolted and not normally used. The roof of the building over the ~~Reactor Laboratory~~ Reactor Room is three feet of earth between five inch thick concrete slabs. A portion of the roof is five feet of earth between five inch thick concrete slabs to provide additional shielding for the Cobalt-60 facility that was located in the laboratory. The laboratory building is located on the southwest corner of the campus. The location of the building can be seen on the campus map in Figure 18. It is building 121 located in section I2.

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Reactor Room

V. Safety of the AGN-201 Reactor Facility

A. Maximum Credible Accident

The total excess reactivity of the reactor is given by the manufacturer as 0.5%. For the purposes of a hazards analysis, however, it is assumed that an instantaneous insertion of 2% in reactivity occurs. Because of its inherently low excess reactivity, the system could never acquire this reactivity in the course of normal operation. It could only occur if improper materials were introduced into the reactor. Strict administrative controls discussed in the next section will normally make this impossible. The placing, for instance, of significant positive reactivity in the glory hole will be strictly forbidden. In this sense, the assumed 2% in reactivity bounds the highest reactivity (about 0.92%) that would be created if the glory hole was completely filled with nominal 20% enriched fuel. This analysis demonstrates the fact that the reactor does not "runaway" following a sudden increase in reactivity.

The analysis of this maximum credible accident is given in Appendix A. It is shown there that this accident leads to a power excursion that is self-limiting in about 300 milliseconds. The maximum temperature of the core never rises above 100 °C. However, tests performed by the manufacturer indicate that the core material, polyethylene, does not melt below 200 °C. It can be expected therefore that such an accident would not damage the core.

As previously noted, various scram circuits would be activated as the result of sudden increase in the flux in the system. However, if for some reason these circuits fail to operate, the reactor would be shutdown by the melting of the fuse. This fuse is loaded with twice the density of uranium as the remainder of the core and would reach substantially higher temperatures than the core during an excursion. In addition, the fuse is made of polystyrene rather than polyethylene and melts at about 100 °C. Following the disintegration of the fuse, the core falls apart, which decreases the reactivity of the system by from 5% to 10% according to the manufacturer.

It is shown in Appendix A that this accident would give a radiation dose of less than 1.1 rem to a person standing immediately next to the concrete shield. This dose, while far from desirable, is well below levels that lead to detectable medical injury.

B. Shielding Requirements for 5-watt operation

As detailed in the amendment for 5-watt operation for Aerojet-General Nucleonics, dated February 11, 1957, and on file with the commission in Docket 50-32, an 18 inch additional concrete shield wall is sufficient to maintain sub-tolerance radiation levels external to the shield

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